N

PATENT ABSTRACTS OF JAPAN

(11)Publication number : **10-284471**

(43)Date of publication of application : **23.10.1998**

(51)Int.Cl. H01L 21/3065
C23F 4/00
H01L 21/68
H02N 13/00

(21)Application number : **09-090578**

(22)Date of filing : **09.04.1997**

(71)Applicant : **NEC YAMAGATA LTD**

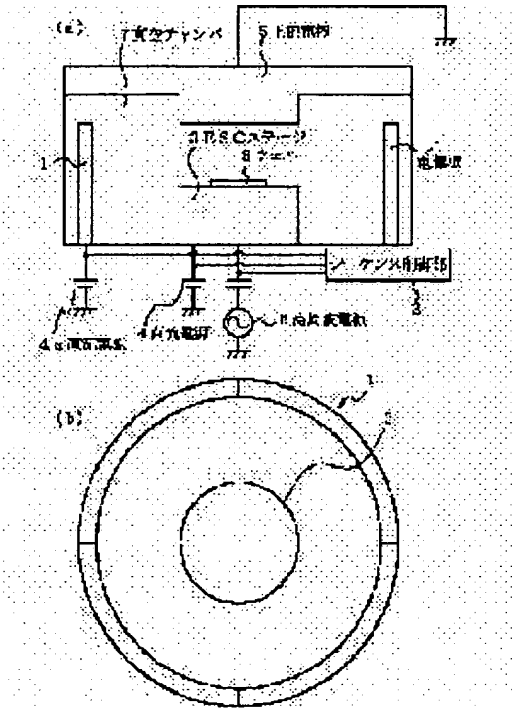
(72)Inventor : **KONNO SATOSHI**

(54) DRY ETCHING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent the adhesion of particles to wafers so as to eliminate the occurrence of defective products due to the particles by capturing floating particles with electrode plates by impressing a larger potential difference than that of an electrostatic chuck stage to the earth upon the electrode plates.

SOLUTION: After a wafer 8 is carried in a vacuum chamber 7 and placed on an electrostatic chuck(FSC) stage 3, a voltage having an absolute value larger than that of the voltage applied across the FSC stage 3 is applied across electrode plates 1 by operating a DC power source 4a with the signal of a sequence control section 2 several seconds before starting etching. When the voltage is applied across the electrode plates 1, charged particles floating in the chamber 7 are attracted to the electrode plates 1. After the floating particles are completely removed, the wafer 8 is chucked by the ESC stage 3 and etched by generating plasma by making an introduced gas to cause glow discharge by operating a high-frequency power source 6 and a DC power source 4 with the signal of a sequence control section 2.



LEGAL STATUS

[Date of request for examination]	09.04.1997
[Date of sending the examiner's decision of rejection]	13.07.1999
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] Provide the electrostatic chuck in which the semi-conductor substrate contained by the vacuum chamber is held by electrostatic adsorption power, and this semi-conductor substrate is laid, and between said electrostatic chuck, this electrostatic chuck, and the up electrode that counters In the dry EIINGU equipment which is made to impress high-frequency voltage and etches said semi-conductor substrate side The electrode plate of the shape of a cylinder of the wall of said vacuum chamber, and said electrostatic chuck arranged so that it may do and said electrostatic chuck may be surrounded, The dry etching system characterized by having the sequence control section to which said high-frequency voltage is made to impress while making into ** said electrical potential difference to which an absolute value impresses a large electrical potential difference to said electrode plate, and it impresses predetermined time to said electrode plate rather than the electrical potential difference impressed to said electrostatic chuck after passing.
[Claim 2] The dry etching system according to claim 1 characterized by carrying out the division-into-equal-parts rate of said electrode plate to plurality.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the dry etching system possessing the electrostatic chuck which carries out adsorption maintenance of the semi-conductor substrate (it is described as a wafer below) by Coulomb force especially about the dry etching system which etches a semi-conductor substrate.
[0002]
[Description of the Prior Art] An electrostatic chuck (Electric Static Chuck) impresses an electrical potential difference to the electrode side of a stage body, and electrostatic adsorption is carried out and it is making the wafer hold. Since this electrostatic chuck (it is described as an ESC stage below) has the good adhesion of a wafer and a stage side compared with the stage of the usual mechanical clamp method, the efficiency of heat transfer of a wafer and a stage body is good, and the cooling effect of a wafer can raise it. For this reason, there is an advantage of homogeneity within a field, such as an etching rate of a wafer, improving, and it is used for many semi-conductor substrate processors.
[0003] Drawing 3 is the type section Fig. showing an example of the conventional dry etching system. This dry etching system is equipped with RF generator 6 which impresses high-frequency voltage to the ESC stage 3 which is the lower electrode which lays a wafer 8 while countering the disc-like up electrode 5 of the vacuum chamber 7 and being arranged, as shown in drawing 3 , and the up electrode 5 and the ESC stage 3, and DC power supply 4 which impress direct current voltage between the ESC stage 3 and a ground.
[0004] High-frequency voltage is impressed by RF generator 6 between this ESC stage 3 and the up electrode 4 which counters, etching gas is introduced into the vacuum chamber 7, the plasma is generated, and it etches into a wafer 8. Moreover, in case this etching is performed, it is the structure which an about [-1000V] electrical potential difference is impressed [structure], carries out electrostatic adsorption of between a wafer 8 and stage sides, and makes a wafer 8 hold during etching by DC power supply 4 at the ESC stage 2 side.
[0005]
[Problem(s) to be Solved by the Invention] In the conventional dry etching system mentioned above, the electrified particle to which impression of the electrical potential difference to a stage electrode floats in a vacuum chamber early rather than impression of high-frequency voltage could draw near to the electrified wafer front face, it adhered and there was a problem of bringing about the serious defect for the quality of the etched wafer.
[0006] Moreover, it is indicated by JP,4-370928,A as a dry etching system with a means to provide the stage of the usual mechanical clamp method which does not use an ESC stage, and to stop particle. With this equipment, the film heater was stuck on the chamber wall, by warming, the resultant was volatilized and deposition of a chamber wall is prevented. Furthermore, it was most made forward potential within the chamber, and the flow of ion is turned to the stage electrode.
[0007] However, in this dry etching system, although adhesion in the chamber wall of the ion from the

plasma under processing can be prevented, the charged particle which floats in a vacuum chamber before etching processing of a wafer does not escape adhesion on a wafer front face. Especially when using the ESC stage where the electrical potential difference was impressed before processing, adhesion of this particle is promoted.

[0008] Therefore, even if the purpose of this invention uses an ESC stage for holding a wafer, it prevents that the particle in which it was charged in the vacuum chamber can draw near to a stage electrode side, and is to offer the dry etching system which can adhere and etch particle into a wafer.

[0009]

[Means for Solving the Problem] The description of this invention Provide the electrostatic chuck in which the semi-conductor substrate contained by the vacuum chamber is held by electrostatic adsorption power, and this semi-conductor substrate is laid, and between said electrostatic chuck, this electrostatic chuck, and the up electrode that counters In the dry EIINGU equipment which is made to impress high-frequency voltage and etches said semi-conductor substrate side The electrode plate of the shape of a cylinder of the wall of said vacuum chamber, and said electrostatic chuck arranged so that it may do and said electrostatic chuck may be surrounded, While making into ** said electrical potential difference to which an absolute value impresses a large electrical potential difference to said electrode plate, and it impresses predetermined time to said electrode plate rather than the electrical potential difference impressed to said electrostatic chuck after passing, it is a dry etching system equipped with the sequence control section to which said high-frequency voltage is made to impress. Moreover, it is desirable to carry out the division-into-equal-parts rate of said electrode plate to plurality.

[0010]

[Embodiment of the Invention] Next, this invention is explained with reference to a drawing.

[0011] Drawing 1 (a) and (b) are the type section Fig. showing the configuration of the equipment for explaining the dry etching system in the gestalt of 1 operation of this invention, and the plan of an electrode plate. This dry etching system is having formed the sequence control section 2 which controls the impression of DC power supply 4 and RF generator 6 which gives negative potential to the electrode plate 1 of the shape of a cylinder of the wall of the vacuum chamber 7, and the ESC stage 3 arranged so that it may do and the ESC stage's 3 may be surrounded, DC-power-supply 4a which impresses negative potential to ******** 1, and these DC power supply and an ESC stage, and the timing of **, as shown in drawing 1 . It is the same as the conventional example except it.

[0012] Moreover, in case it etches into a wafer 8 with this dry etching system, it is the structure which an about [-1000V] negative electrical potential difference is impressed [structure], carries out electrostatic adsorption of between a wafer 8 and the ESC stages 3, and makes a wafer 8 hold during etching by DC power supply 4 at the electrode side of the ESC stage 3. On the other hand, the conductive electrode plate 1 is installed inside the vacuum chamber 7. Although the quality of the material of this electrode plate 1 should just be conductivity, in order to make it easy to deal with it for a maintenance or exchange, the electrode plate 1 is divided into division into equal parts at plurality, and its lightweight aluminum is desirable. A negative electrical potential difference with a larger absolute value than the electrical potential difference of the ESC stage 3 is made to impress to this electrode plate 1 by DC-power-supply 4a. For example, what is necessary is just to impress an about [-1100V] electrical potential difference to the electrode plate 1, if an ESC electrical potential difference becomes -1000V.

[0013] Drawing 2 is a timing diagram for explaining actuation of the dry etching system of drawing 1 . Next, actuation of this dry etching system is explained with reference to drawing 1 and drawing 2 . First, a wafer 8 is carried in to the vacuum chamber 7, and it is laid in the ESC stage 3, and DC-power-supply 4a operates with the signal of the sequence control section 2 about several seconds ago, and an electrical potential difference with a larger absolute value than the electrical potential difference for which etching is started and which should be impressed to the electrode plate 1 on the ESC stage 3 is impressed. The particle by which it was electrified [which floats in the vacuum chamber 7 by this] is attracted by the electrode plate 1.

[0014] And RF generator 6 and DC power supply 4 operate with the signal of the sequence control

section 2 after the time amount progress considered that the floating particle is lost completely, the gas which carried out adsorption maintenance and was introduced into the ESC stage 3 by impression of high-frequency voltage carries out glow discharge of the wafer 8, the plasma is generated, and a wafer 8 is etched. Then, the switch of RF generator 6 and the switch of DC power supply 4 are turned OFF with the signal of the sequence control section 2, and adsorption of the wafer 8 by the ESC stage 3 is released at the same time it carries out etching termination.

[0015] Thus, it is lost that migration of the particle by the side of the ESC stage 3 becomes absolutely none, and particle adheres to the front face of a wafer 8 by controlling.

[0016]

[Effect of the Invention] As explained above, it can prevent that particle makes this invention adhere to a wafer by arranging an electrode plate so that the perimeter of an ESC stage may be surrounded, impressing the bigger potential difference than the potential difference over the ground of an ESC stage to an electrode plate, and making an electrode plate catch the floating particle, and it is effective in the ability to abolish the defect of the product by particle adhesion.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] They are the type section Fig. showing the configuration of the equipment for explaining the dry etching system in the gestalt of 1 operation of this invention, and the plan of an electrode plate.
[Drawing 2] It is a timing diagram for explaining actuation of the dry etching system of drawing 1 .
[Drawing 3] It is the type section Fig. showing an example of the conventional dry etching system.
[Description of Notations]
1 Electrode Plate
2 Sequence Control Section
3 ESC Stage
4 4a DC power supply
5 Up Electrode
6 RF Generator
7 Vacuum Chamber
8 Wafer

[Translation done.]